Journalist Fellowship Paper

The non-scientist's guide to reporting on climate repair

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Introduction

“At first, I thought it was a joke,” said Senara Wilson-Hodges, a town councillor for St Ives, Cornwall. “Everyone thought it was a joke.”

A rumour was circulating in St Ives that a Canadian company planned to tip a chemical derived from mining waste into the bay – right off the coast of one of the most overtouristed towns in the United Kingdom.[1] Many people in St Ives make their living from the beauty of the place, and all of them put up with clogged roads, oblivious visitors, and ludicrous house prices for the sake of it.

When Planetary Technologies finally held a series of public meetings about their project, Wilson-Hodges didn’t feel she understood it better. The company was going to put magnesium hydroxide into the sea. But what was that? Did they have permission? How would it affect marine life?

The company said this chemical would help to reverse climate change. Magnesium hydroxide would change the pH of the water, making it more alkaline – the opposite of acidic. Alkaline water would absorb carbon dioxide from the atmosphere more quickly. Too much carbon dioxide in the atmosphere was causing the climate crisis in the first place.

“It’ll be great for tourism,” said Pete Chargin, Planetary Technologies’ vice-president – to the horror and confusion of the crowd.

After the meetings, rumours swirled. Was this simply a clever way for a mine overseas to get rid of its waste? Did this have anything to do with a recent G7 meeting in Cornwall – had it been agreed on secretly by world leaders? Or had St Ives been chosen simply because it was picturesque and the company wanted attractive pictures to lure investors?

Suspicion surged when the community discovered that one test had already taken place in the bay without their knowledge.

Wilson-Hodges and other locals did not know where to turn for impartial, objective analysis of the company’s claims. Planetary Technologies was testing a relatively

[1] The Guardian. (2024). ‘It’s Just A Rich Man’s Playground Now’: How St Ives Became Patient Zero of British Overtourism. Retrieved from https://www.theguardian.com/uk-news/article/2024/aug/10/its-just-a-rich-mans-playground-now-how-st-ives-became-patient-zero-of-british-overtourism

new idea called ocean alkalinity enhancement – so new, in fact, that very little came up when anyone Googled it. The community couldn't find reassurance that it was safe. They couldn't find much about it at all.

Rethinking the role of journalism

The science underpinning climate-repair projects is new and complex, making it difficult for non-experts to understand the mechanisms at work, let alone to critically assess them.

At first, it's easy to see how journalism can help. Our job as journalists is to establish what's true, to figure out when someone is bluffing or exaggerating, and to fact-check whether assertions are based on evidence.

Yet the questions raised around climate-repair projects fall outside the boundaries of what can be objectively proved or disproved. Neither scientists nor the public will know, in advance, the full impact of proposed trials or technologies. That means decisions about whether to deploy climate-repair technologies will not be based on facts, but on risk probabilities.

Somehow, we must decide which projects should go ahead and which should be set aside – and these will not be scientific decisions but societal and political ones. "Risk tolerance is not something that's fundamentally scientific," social scientist Sikina Jinnah, a professor at University of California at Santa Cruz, told me. "Risk tolerance is a social choice."

This is less familiar ground for journalists – yet journalists have a crucial role to play in terms of helping people understand and discuss risk.

We can ensure risks are correctly presented, neither overblown nor undercooked, and we can supply relevant context and scale. We can ensure that climate-repair technologies are portrayed neither in overly rosy terms nor overly catastrophic terms, but rather, in the appropriate proportion.

In other words, we can create the landscape for productive, well-informed public conversations.

It's all about risk

People are generally terrible at understanding risk.[2] Also, people are generally terrible at communicating risk.[3]

Deciding whether or not to deploy climate technologies is largely about weighing up risks. Some parties will be motivated to downplay risks, while others may have an incentive to overstate them.

Journalists have the right set of skills to help: the ability to fact-check the proportionality of various risks, the ability to interview experts who may not be the most effective communicators, and the ability to translate that expert information for the general public.

Falling into the deficit trap

News coverage of the Planetary Technologies trial in Cornwall failed both the company and the community of St Ives. Stories about the project followed a 'he said, she said' format, quoting community members concerned that the chemical would affect ocean life, followed by Planetary Technologies' assurances that the whole thing was perfectly safe.[4]

A typical journalistic critique would point out that there was no appeal to external expertise, either to judge the company's claims or address the community's questions. Perhaps that would have been helpful for some community members, but independent expertise alone won't lead to productive public discussion.

It's a common assumption among science communicators that the public, once given more facts, will immediately appreciate scientists better and subsequently make more rational decisions. (This goes along with the assumption that people who don't trust scientists simply lack information and/or education.)

This is known as the 'deficit model' of science communication, and it is incorrect. People are not blank slates awaiting facts, wrote social scientist Holly Jean Buck: "Decades of social science research have basically debunked the deficit model: as a

[2] The New York Times. (2020). Why You're Probably Not So Great at Risk Assessment. Retrieved from https://www.nytimes.com/2020/06/30/smarter-living/why-youre-probably-not-so-great-at-risk-assessment.html

[3] The Conversation. (2017). Why Don't People Get It? Seven Ways That Communicating Risk Can Fail. Retrieved from https://theconversation.com/why-dont-people-get-it-seven-ways-that-communicating-risk-can-fail-68912

[4] The Guardian. (2023). Protesters Urge Caution Over St Ives Climate Trial Amid Chemical Plans for Bay. Retrieved from https://www.theguardian.com/uk-news/2023/apr/17/protesters-urge-caution-over-st-ives-climate-trial-amid-chemical-plans-for-bay-planetary-technologies

2017 National Academies of Sciences report stated flatly, this model is wrong.[5] Audiences often understand what scientists know but don't act consistently with the science because they are taking into account their own goals, needs, skills, values, and beliefs."[6]

This puts journalism into uncharted territory. If giving people facts doesn't help when it comes to addressing misinformation, what should we do? Giving people facts is the journalistic mode!

Perhaps, instead, we could act as conduits between community concerns and trustworthy people who are able to listen and respond. By 'trustworthy', I mean people that a community trusts, not people we as journalists trust.

We know from misinformation research that where distrust occurs, facts cease to have meaning. Perhaps journalism is entering a stage where identifying sources who are trustworthy to a community is vital, just as identifying sources who tell the truth is vital. Journalism's aim could be to foster discussion in real time rather than to repeat arguments that sail past each other, never to be caught and returned by the opposing side.

Factual scrutiny is still necessary

Many climate-repair projects don't live within the normal ecosystem of science. They are more often led by start-up companies than by universities or government-funded research institutes. That means their work isn't peer-reviewed, and isn't subject to the same kind of checks and balances as traditional research.

Planetary Technologies, to its credit, openly published its methods online and hoped to attract external oversight. Yet I could not find an example of a journalist who had asked an expert to review any of this material.

There's an advantage to the start-up approach: academic publishing is incredibly slow. Entrepreneurs work much more quickly. This has drawn many scientists from academia to companies like Planetary Technologies. These are people who know that time is running out to address climate change, and who want to make a difference.

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[5] National Academies of Sciences, Engineering, and Medicine. (2017). Communicating Science Effectively: A Research Agenda. The National Academies Press. https://doi.org/10.17226/23674

[6] Jacobin. (2024). Obsessing Over Climate Disinformation Is a Wrong Turn. Retrieved from https://jacobin.com/2024/08/climate-disinformation-green-transition-workers

The cost of increased speed is a lack of oversight and corresponding lack of public trust. That makes journalism vital, as media can provide or prompt an increase in scrutiny.

You can't repair bad communication

We don't know yet if ocean alkalinity enhancement works, but we have lost the opportunity to find out – in the context of St Ives, at least. An independent review of Planetary Technologies' plans, commissioned by the British government's Environment Agency, concluded that the project was "very low risk", but this did not reduce opposition in St Ives.[7, 8] Planetary Technologies cancelled the project in April 2025.

British social scientist Emily Cox, who studies carbon-removal projects, told me that once a project becomes stigmatised in the public eye, it's essentially impossible to rehabilitate its image. "I'm not aware of examples of where, in the case of stigmatisation, where that's occurred, that anyone's managed to change that discourse after the fact," she told me.

I visited Cornwall in 2023 to speak to community members about Planetary Technologies' project, and heard first-hand about the anxiety that it had caused them. I also discovered that there was a lot of misinformation circulating about the project, some of which I heard from my bed-and-breakfast host. (On learning that I was a science journalist, she sighed and said, "You're not here about that magnesium bullshit, are you?")

In reporting on contentious issues such as the COVID-19 vaccines during lockdown, I found that taking time to listen to a person's concerns, seek out answers to their questions, and talk through scientific uncertainties helped reduce their stress and sense of powerlessness. When we discussed risks and I explained why I trusted certain sources and not others, people seemed to relax their adversarial stances and engage more openly.

While my experiences are extremely limited, social science research confirms that they are not unusual. Certain types of communication can foster openness,

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[7] BBC. (2024). St Ives Bay Carbon Capture Trial 'Very Low Risk' – Report. Retrieved from https://www.bbc.co.uk/news/uk-england-cornwall-68277585

[8] Hakai. (2024). A Dose of Antacids, a Quaint British Bay, and a Public Relations Fiasco. Retrieved from https://hakaimagazine.com/features/a-dose-of-antacids-a-quaint-british-bay-and-a-public-relations-fiasco

discussion, and changes of opinion, while other types foreclose it.[9] Reducing stress is key to preventing the spread of conspiracy theories; feelings of anxiety make people more likely to share misinformation.[10]

Perhaps journalism could have spared St Ives community members from some of the anxiety they experienced, and from the sense of powerlessness they felt over what was taking place in their home.

Where to from here?

The first step towards better journalistic coverage of climate-repair technology is a better understanding of a complex set of ideas. The first part of this project breaks down science and terminology in an accessible way.

The second step is to look at what we're getting right and where we're going wrong – with a clear strategy for better journalism about climate repair initiatives. That's in part two.

[9] Rob Bellamy—personal interview.

[10] National Academies of Sciences, Engineering, and Medicine. (2017). Communicating Science Effectively: A Research Agenda. The National Academies Press. https://doi.org/10.17226/23674

Part one: What is climate repair?

Around the world, scientists are working on new technologies that they hope will halt or mitigate climate change. In general, 'climate repair' projects aim to either:

1. Reduce the total amount of carbon dioxide in the atmosphere,
2. Reflect sunlight to prevent it from heating up the planet.

It has long been established that, if we want to stop the planet from warming by more than 2°C, we need to reduce the amount of carbon dioxide we're adding to the atmosphere every day.

More recently, scientists have calculated that in order to meet the 2°C target, we also need to remove some of the carbon dioxide that we've already released.

Carbon dioxide removal is sometimes described as an optional technology – as nice-to-have, or as a "dangerous distraction" from reducing emissions. In fact, carbon-dioxide removal is essential to meeting our climate goals – though we have no hope of achieving those goals if we don't reduce emissions at the same time.

Reflecting sunlight is currently a nice-to-have technology. It won't solve the root cause of climate change, but it may help to prevent irreversible damage.

Both types of climate-repair technology are frequently controversial. They can be risky, expensive, industrial, or resource-intensive, and they often involve using or modifying ecosystems that communities depend on to live.

Soon, we will need to make some difficult choices about whether to deploy these technologies, and if so, where. These will not be scientific choices but social ones, because they will involve balancing risks.

Geoengineering: a bad word?

These technologies don't share a universally agreed-upon name. We used to bundle them all under the word 'geoengineering', but that's now considered dated – and has also been co-opted by conspiracist movements. That's why I've chosen 'climate repair'.

You might find these described variously as 'climate solutions', 'climate interventions', 'climate engineering', or 'climate remediation', depending on what the source wishes to emphasise. We'll talk more about the impact of word choices on page 30.

Can carbon removal reverse climate change?

To recap: climate change is happening because there's more carbon dioxide in the atmosphere than ever before. Carbon removal is now necessary for limiting warming to 1.5°C, or even 2°C, according to the Intergovernmental Panel on Climate Change (IPCC), the global authority on climate science.

"Even if we start rapid emissions reductions tomorrow, we will very likely pass 1.5°C by the early 2030s," wrote climate scientist Zeke Hausfather. Current policies, Hausfather added, will see us passing 2°C in the early 2050s.[11]

Could we just miss our climate goals, even by a little bit? Not without terrible effects. Officially, 2°C is "the threshold of catastrophe", wrote *New Yorker* climate correspondent Elizabeth Kolbert.[12]

In fact, experts advocate for limiting warming to 1.5°C in order to avoid the loss of certain ecosystems and disastrous weather impacts. As climate scientist Kate Marvel pointed out on Bluesky, the impacts of warming aren't simply to do with heat:

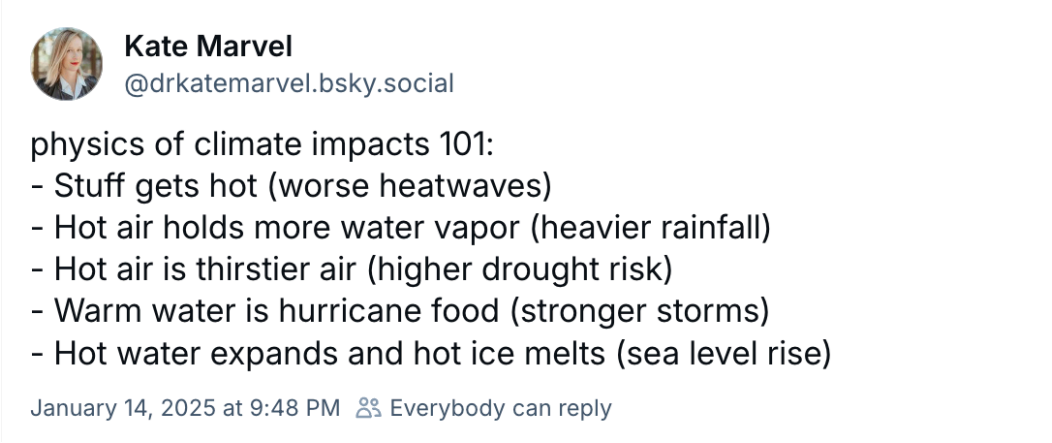

Image: Screengrab

Avoiding the threshold of catastrophe

The faster we find ways to soak up carbon dioxide and store it away, the better chance we have of meeting our climate goals.

[11] The Climate Brink. (2024). The Geoengineering Question. Retrieved from https://www.theclimatebrink.com/p/the-geoengineering-question
[12] Kolbert, E. (2021). Under a White Sky. Penguin Books.

The new industry of carbon-dioxide removal has sprung up to meet this demand. It's growing quickly, with more than 500 start-ups documented in 2024.[13] Academia has been slower to respond: in 2023, three times as much funding went into carbon-removal start-ups as academic research.

The catch is that carbon-dioxide removal will only help if we stop emitting so much carbon dioxide at the same time. Perhaps this sounds like overkill: couldn't vacuuming CO_2 out of the atmosphere solve the problem single-handedly?

Here's why carbon removal alone won't work:

If the atmosphere was a bathtub

Let's say you left the tap running, and now your bathtub is overflowing. You pull the plug out of the bath. Does this stop your bathroom from flooding?[14]

Not in the slightest. You haven't turned the tap off, so the amount of water in the bathtub hasn't changed, and the tub is still overflowing. Less water is spilling out of it than before, but your bathroom floor is still getting soggier and soggier.

The only way to stop the bathtub overflowing is to turn the tap off, or at least to turn it down, so that the drain can empty the tub faster than the tap is filling it.

Currently, our bathtub has a very small drain – a mere trickle – while our tap is on full blast. We need to increase the size of the drain at the same time as we turn off the tap.[15]

So, why don't we just make the drain bigger? We don't know how. Right now, we don't have the technology to quickly suck up carbon dioxide and store it away. The most reliable methods we have, such as planting trees, take a long time.

Carbon removal is a bit like time travel, according to climate scientist David Ho, a professor at the University of Hawai'i at Mānoa. In a way, it winds the clock back to a time when our emissions were lower. But it can't take us back very far. Removing 500,000 tonnes of CO_2 from the atmosphere sounds like a lot, but it only turns the clock back six minutes and 45 seconds, Ho pointed out on X.

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[13] Smith, S. M., Geden, O., Gidden, M. J., Lamb, W. F., Nemet, G. F., Minx, J. C., Buck, H., Burke, J., Cox, E., Edwards, M. R., Fuss, S., Johnstone, I., Müller-Hansen, F., Pongratz, J., Probst, B. S., Roe, S., Schenuit, F., Schulte, I., Vaughan, N. E. (2024). The State of Carbon Dioxide Removal. https://doi.org/10.17605/OSF.IO/F85QJ

[14] This analogy is drawn from Holly Jean Buck's book *After Geoengineering* and is also used by Elizabeth Kolbert in *Under a White Sky*, and by many climate communicators.

[15] Buck, H. J. (2019). *After Geoengineering*. Verso Books.

Keep in mind that emitting CO_2 into the atmosphere has a delayed effect, so we haven't yet experienced the full warming effects of all the carbon dioxide we've released.

Also, carbon removal won't wind the clock back on all the ecosystem damage that climate change has caused so far: it can only delay how much might occur in future.

A matter of urgency

It's true that carbon removal wasn't always a must-have. The IPCC first recognised that it was critical in 2022.[16] That's because we've missed all our goals for emissions reductions so far, which means we need to put in even more effort to get across the finish line. It's a bit like the biathlon – the cross-country skiing race combined with rifle shooting. Every time we miss a target, we have to do a penalty loop of a whole different course.

In order to meet our climate goals, the carbon-removal industry needs to scale up exponentially, said Ho, to a level that's hard to fathom: "It's got to go from something that most people have never heard of to the biggest industry the world has ever seen in a really short time – and at a faster ramp-up rate than anything else that we've done."

Is carbon removal a 'dangerous distraction'?

Though carbon removal is necessary for meeting our climate goals, it is frequently characterised in media as dangerous or amoral: a trick to distract us from reducing emissions. (Some of these articles mix up carbon removal with a different industry, carbon capture. For more on that, see page 27.)

This idea (that the existence of the carbon-removal industry will provide an excuse for bad actors to give up on reducing their emissions) is called 'mitigation deterrence'. Certainly, to a government or company wishing to avoid the expense and upheaval of decarbonisation, carbon removal looks pretty attractive.

"It is useful to be able to act like these new technologies are achieving more than they actually are," said Cox. "A lot of countries have a political discourse that is actively trying to delay action on climate change – is actively trying to not do

[16] Physics Today. (2022). Carbon Dioxide Removal is Suddenly Obtaining Credibility and Support. Retrieved from https://pubs.aip.org/physicstoday/article/75/6/26/2844713/Carbon-dioxide-removal-is-suddenly-obtaining

emissions reduction – and in that case, portraying carbon removal in this very techno-optimistic way and this very silver-bullet way is useful."

Hype about carbon removal (overstating its possibilities) is certainly a dangerous distraction, wrote MIT Technology Review journalist James Temple.[17] As Buck told Temple: "There will be a risk of fossil-fuel companies and others using carbon removal as an imagined way to not shift their business models."

A way to avoid this, Temple wrote, would be for governments to introduce policies preventing carbon removal from counting towards emissions reductions.

It's not going to be possible to reduce all our emissions, because some of them are generated by critical industries – like growing food. Experts agree that carbon removal should only be used as offsets to cover these 'residual emissions'. What counts as a residual emission remains a matter of some debate.[18]

[17] MIT Technology Review. (2021). Carbon Removal Hype Is Becoming a Dangerous Distraction. Retrieved from https://www.technologyreview.com/2021/07/08/1027908/carbon-removal-hype-is-a-dangerous-distraction-climate-change

[18] Buck, H.J., Carton, W., Lund, J.F., Markusson, N. (2023). Why Residual Emissions Matter Right Now. Nature Climate Change 13. https://doi.org/10.1038/s41558-022-01592-2

Carbon removal: a how-to guide

There are myriad ways to soak up carbon dioxide from the atmosphere, many of them involving the planet's ecosystems. The ocean absorbs carbon dioxide. Plants build themselves from it. Trees inhale it. Rocks, soil and wetlands soak it up.

Most of the ideas for large-scale carbon removal involve attempting to speed up or augment these natural processes:

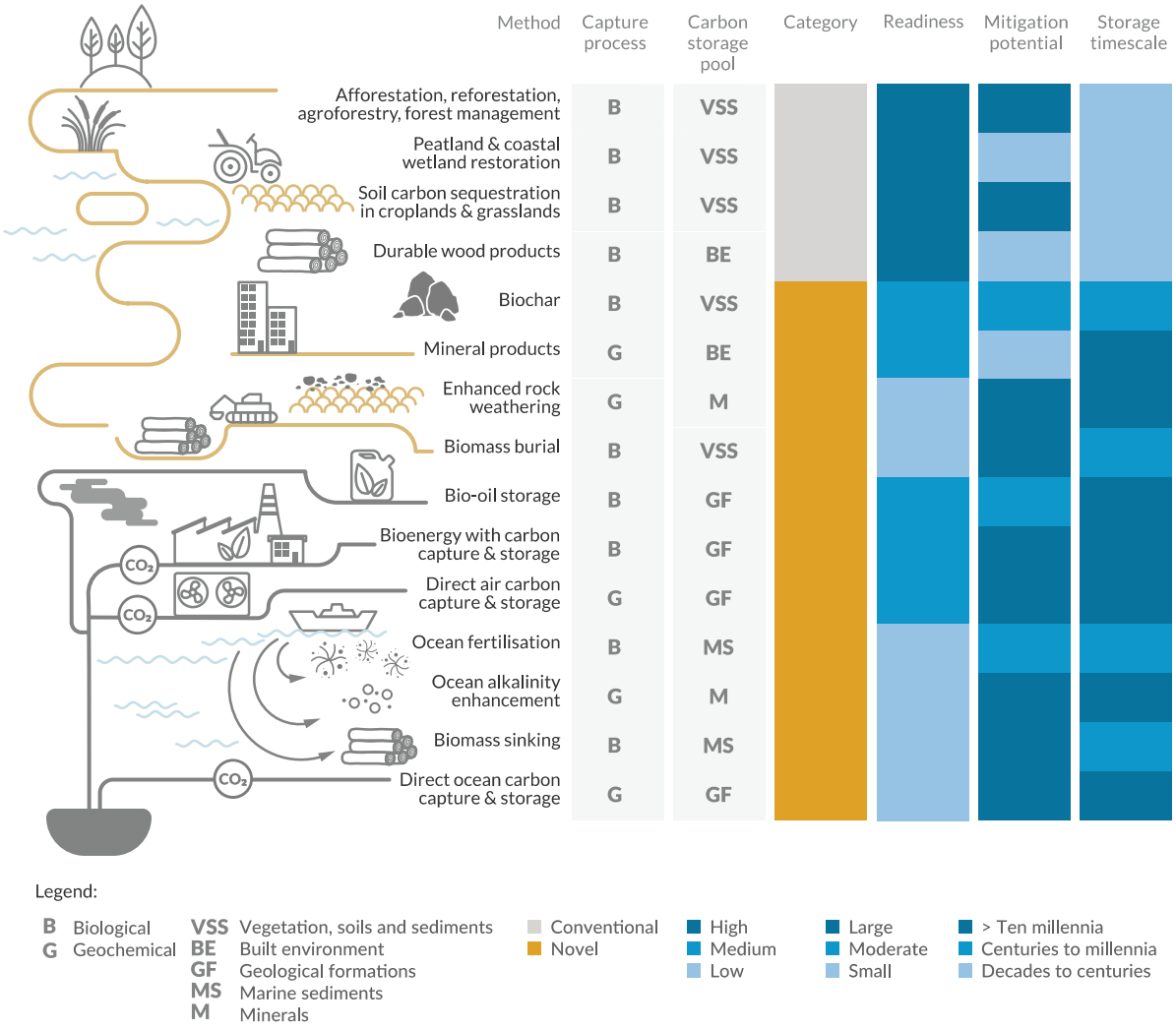

Image: The State of Carbon Dioxide Removal 2024[19]

[19] Smith, S. M., Geden, O., Gidden, M. J., Lamb, W. F., Nemet, G. F., Minx, J. C., Buck, H., Burke, J., Cox, E., Edwards, M. R., Fuss, S., Johnstone, I., Müller-Hansen, F., Pongratz, J., Probst, B. S., Roe, S., Schenuit, F., Schulte, I., Vaughan, N. E. (2024). The State of Carbon Dioxide Removal. https://doi.org/10.17605/OSF.IO/F85QJ

But the most important distinction between carbon-removal types isn't natural or industrial, it's whether they're old or new – *conventional* or *novel*. That's illustrated by the yellow bar in the above graphic.

What's the difference? We know that *conventional methods* work. They're things like trees and wetlands; they'll soak up carbon dioxide and lock it away long-term. The *novel methods* work in theory, but we're not yet sure if they work in practice.

It might sound like it's worth throwing our money and time behind conventional methods, but the IPCC has calculated that we need novel methods, too – perhaps even methods that don't yet exist – if we're going to meet our climate goals. That's because we don't have an unlimited amount of land to use, and conventional methods take up a lot of space. (The Land Gap Report tracks the amount of land that's been pledged to carbon-removal purposes; it's already too much.)

In addition, we don't have time to wait for trees to grow: we need to find methods that work more quickly.

Novel carbon-removal method

Multiple start-ups are working on new methods of carbon removal.

Direct air capture

This takes place in giant factory-like facilities and, in simple terms, involves vacuuming the air, extracting the carbon dioxide from it, turning it into rock, and storing it deep underground. This BBC story, which we'll return to later, is an interesting look inside one of the biggest direct air capture (DAC) plants in the world.[20]

Direct ocean capture

Same thing, but in the sea. The ocean absorbs carbon dioxide from the atmosphere, and when it does so, this changes the pH of the water – makes it more acid, less alkaline. (This is why ocean acidification occurs.) It's possible to extract carbon dioxide from the water.

Ocean alkalinity enhancement

The ocean and the atmosphere like to have the same amount of carbon dioxide; if one has more than the other, they will slowly equilibrate. Currently the atmosphere has more, so the ocean will gradually absorb it over the next few

[20] BBC. (2024). Is Carbon Capture an Effective Way to Tackle CO2? Retrieved from https://www.bbc.co.uk/news/articles/clmydee2grno

hundred years. If there were less CO_2 on the surface of the water, the ocean would absorb CO_2 from the atmosphere more quickly. There are several ways of decreasing surface carbon dioxide; one way is to add a chemical to make the top layer of seawater more alkaline and less acidic.

Ocean fertilisation

What soaks up CO_2 as it grows? A tree, yes – but also tiny marine plants called phytoplankton. Phytoplankton eat nutrients such as iron or phosphorus – even the ash from wildfires and the dust blowing off the Gobi desert are delicious to them. So, could we tip the right nutrients into the sea to help phytoplankton grow, absorbing CO_2 in the process? And would they store CO_2 for a long time, or release it all again when they die?

Enhanced rock weathering

Rocks are full of minerals, and the slow erosion of them by rainfall, river flow or wave action releases those minerals into the sea. Some minerals make the seawater more alkaline. So, if we sprinkled a beach with alkaline rocks, the action of the waves would slowly release minerals over time, turning the water more alkaline and drawing down more CO_2 from the atmosphere. In theory, at least.

Biochar

If you burn organic waste from forestry or farming – what's called biomass – in a low-oxygen environment, you end up with chalky black lumps of carbon. If mixed in with soil, biochar may store carbon for a long time.

Biomass sinking

When trees grow, they build themselves out of CO_2 that they draw from the atmosphere. When trees die or are burned, they release all that CO_2 again… unless you sink them to the bottom of the sea, where the carbon dioxide cannot escape.

Growing whales

This does not appear in official reports because it's not a realistic carbon-removal solution, but it does keep coming up in the media. The idea is that whales are a bit like the ocean's version of a tree: they grow very large, which requires a lot of CO_2. There are clear benefits to conserving whale populations, but it is less clear how we might plant new whales en masse in the same way as planting forests for carbon removal.

Conventional carbon-removal methods

Many types of ecosystem naturally absorb and store carbon on their own: forests, soil, grasslands, peatlands, and wetlands. By protecting or restoring these ecosystems, we can help them store more carbon. These methods generally take up a lot of land area and are pretty slow, so the IPCC has calculated that we can't rely on these methods alone to remove all the carbon we need to get rid of.

How do you know when you've removed some carbon?

If you knew the answer to this question, you could probably make a lot of money, because this is surprisingly difficult to figure out.

And this is the biggest challenge facing the industry: how to measure when carbon has genuinely been removed – and when it hasn't.

For instance, it's not even clear to us how much CO_2 trees store: it depends on the tree, the soil, the environment. More than one researcher has pointed out that it's probably better to conserve existing forests than plant new ones, because old growth stores more carbon.[21]

One illustration of how hard it is to measure carbon fluxes is the pair of stories published within months of each other, 'The Southern Ocean may be less of a carbon sink than we thought', and 'Southern Ocean absorbing more CO_2 than previously thought', pointed out on X by oceanographer Andrew Yool.

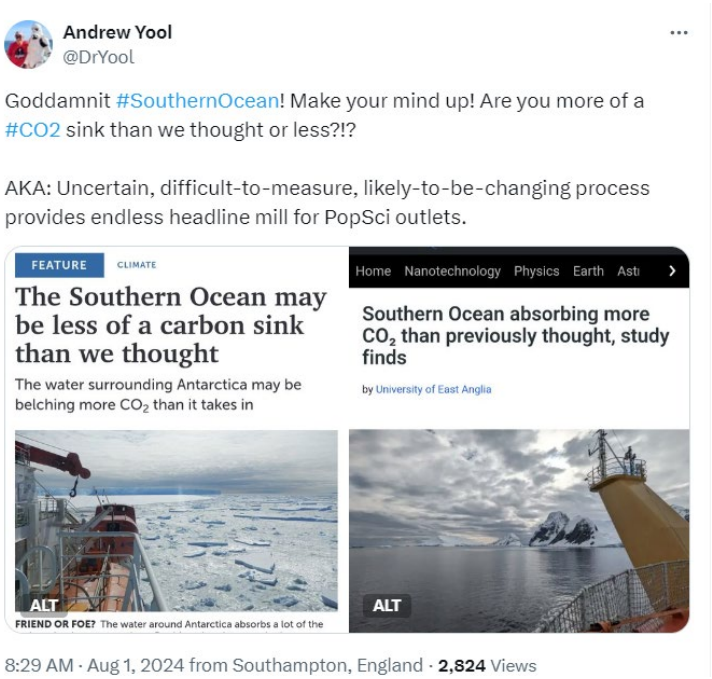

Image: Screengrab

[21] MIT Climate Portal. (Unknown.) How Many New Trees Would We Need to Offset Our Carbon Emissions? Retrieved from https://climate.mit.edu/ask-mit/how-many-new-trees-would-we-need-offset-our-carbon-emissions

That's why there's a parallel industry springing up, called 'measurement, reporting, and verification', or MRV. The idea is that carbon-removal projects shouldn't be marking their own homework: there needs to be a separate entity measuring whether they're doing what they claim.

MRV systems differ depending on what type of carbon-removal strategy is in play. To demystify this, former scientist Anu Khan launched a non-profit called the Carbon Removal Standards Initiative, which plans to advise industry, media, and the public about whether or not the right measuring tools are being used.

It's possible that we don't have a good picture of how much carbon is being removed at the moment, because reports such as *The State of Carbon Dioxide Removal* use companies' own removal claims in their accounting – something that report co-author Steve Smith describes as a loose end.

When does removal actually count as removal?

It's not fair to point to a forest that already exists and claim you're removing carbon dioxide. You're supposed to plant a new forest. But if you were unethical, one money-making idea would be to acquire some forested land, call it "managed", and begin selling carbon-removal credits based on it.

In other words, it's important to ascertain that carbon removal is based on new activities, not on counting up carbon sinks that already exist.

The basics of blocking the sun

It sounds like a concept from science fiction: release a cloud of tiny particles into the upper atmosphere, which will bounce the light of the sun back into space, preventing all its heat from reaching Earth.

This technology is called 'solar radiation modification', and we're already doing it, every day, around the world.

Air pollution from industry and transport, especially container shipping, acts exactly as we'd expect solar radiation modification to do. Shipping emissions create clouds which deflect the sun. When new shipping fuel regulations in 2020 reduced the amount of sulphur dioxide that ships emitted – thus reducing air pollution – the change resulted in a surprise bump in global warming.

One study estimated that this may have as much as doubled the warming rate during the 2020s.[22] "We did inadvertent geoengineering for 50 or 100 years over the ocean," Tianle Yuan, who led the study, told *The Guardian*.[23]

Sometimes, natural processes cause a little bit – or a lot – of solar radiation modification. The largest-scale example in recorded history took place in 1815, when the violent eruption of Mount Tambora in Indonesia cooled the planet, causing widespread famine. The following year was known in parts of the Northern Hemisphere as the *Year Without a Summer*.

Researchers are now testing whether it's possible to intentionally conduct the first type of planetary cooling (the kind inadvertently caused by shipping emissions) rather than the second (the kind that resulted in major crop failure).

[22] Yuan, T., Song, H., Oreopoulos, L. (2024). Abrupt Reduction in Shipping Emission as an Inadvertent Geoengineering Termination Shock Produces Substantial Radiative Warming. Communications Earth & Environment 5, 281. https://doi.org/10.1038/s43247-024-01442-3

[23] The Guardian. (2024). 'Termination Shock': Cut In Ship Pollution Sparked Global Heating Spurt. Retrieved from https://www.theguardian.com/environment/article/2024/may/30/termination-shock-cut-in-ship-pollution-sparked-global-heating-spurt

Types of solar radiation modification

These ideas are also known popularly as 'solar geoengineering'. A 2025 Royal Society policy briefing describes the state of research of each of these methods – what we know and what we don't know – in more detail.[24]

Marine cloud brightening

Researchers are testing whether it's possible to create clouds over patches of the world that are warming quickly, such as areas of the Arctic (to prevent ice melting) or the Great Barrier Reef (to prevent coral bleaching).

Stratospheric aerosol injection

Scientists theorise that releasing small particles of sulphur dioxide or calcium carbonate into the stratosphere (the layer of the atmosphere above our own) will cause global cooling. This idea hasn't yet been put to the test in the real world, but it's what some giant volcanic eruptions do.

Surface albedo modification

Lighter colours reflect more sunlight than darker colours, preventing heat from being absorbed. This is why sea ice melting is such a problem; ice reflects lots of sunlight, but seawater is dark and absorbs it, warming the ocean and accelerating sea-ice melt. One of the cheapest ways to modify albedo is to paint buildings white; a new branch of research is investigating covering the ocean surface in foam.

Why solar radiation modification attracts controversy

Solar radiation modification does not address the root cause of climate change – it may cool some areas temporarily but does not stop the warming mechanism from continuing to ramp up behind the scenes. As a result, the IPCC says that solar geoengineering "cannot be the main policy response to climate change" but that it may be a "supplement" to achieving net-zero emissions.[25]

That means there are several risks around its potential use:

1. If we start solar geoengineering, we won't be able to stop without causing a dramatic increase in warming. This idea is known as 'termination shock'.

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[24] The Royal Society. (2025). Solar Radiation Modification: Policy Briefing. Retrieved from https://royalsociety.org/news-resources/projects/solar-radiation-modification

[25] Carbon Brief. (2022). In-Depth Q&A: The IPCC's Sixth Assessment on How to Tackle Climate Change. Retrieved from https://www.carbonbrief.org/in-depth-qa-the-ipccs-sixth-assessment-on-how-to-tackle-climate-change

2. Unlike carbon removal, solar geoengineering doesn't require a lot of infrastructure. What's to stop any random person or government from blocking the sun?
3. Companies that don't want to reduce their emissions might advocate for (or simply use) solar geoengineering instead.
4. These technologies are in the theoretical stage – we don't know yet how to safely modify the stratosphere, and we've only just started testing how to augment clouds.

Should the research even be done?

In principle, we know how to cool the planet like volcanoes do. In practical terms, we don't.. Some scientists say we should research these technologies as soon as possible, so that we have them available if we wish to use them.

Opponents of solar geoengineering argue that doing the research means we'll end up using these technologies no matter what – that they will become a kind of terrible knowledge that cannot be ignored.

In the scientific community, there are advocacy movements both for and against solar radiation modification. Many researchers have signed a call for responsible research into solar geoengineering, and many have signed a call for not researching it at all.

Claudia Wieners, who advocates for responsible research, believes that science with good guardrails will help defend against bad actors. She defines that as publicly funded research that shares data, especially with Global South nations. "Now, if this does not happen, and some dubious-faith actors do SRM research or claim to do it, there's no knowledge base to measure that against," said Wieners. "So it's maybe better to do it in an open, collaborative, transparent, international way than to try to ban it."

Opponents argue that while more research might reduce the scientific risks, it won't reduce the political risks – or the fact that the use of solar geoengineering might exacerbate existing inequalities and power imbalances.

Wieners believes that most scientists involved in the debate agree on the dangers of runaway climate change and the dangers of solar geoengineering. "The difference is more on how you weigh them," she said, "than on whether these risks exist at all."

Who gets a say in the research?

Instead of leaving it up to scientists to debate solar radiation modification, the non-profit Alliance for Just Deliberation on Solar Geoengineering (DSG) is working to foster public conversations about the technology.

After all, said Sikina Jinnah, the question of how we handle risk is a public one: "When there's significant risk to be managed or considered, I think publics have to have voices earlier in the conversation."

Another argument often made against solar radiation modification is that researching or deploying it would be unfair to Global South nations – a form of climate colonialism. However, international research looking at what the public thinks of these technologies finds that people in the Global South are, on average, much more interested in solar geoengineering than people in the Global North.[26]

Who is backing the research?

Whitney Peterson, director of strategy and communications at DSG, believes that funding for solar geoengineering projects should be openly declared, and that media have a big role to play in terms of providing scrutiny. It's important to know if solar geoengineering is backed by big emitters, such as fossil-fuel companies which are invested in preserving the status quo.

"The continued exponential funding from billionaires in particular, and from these major philanthropic organisations that billionaires have created, is very interesting to witness, as well as something to keep the pulse of," said Peterson. "I would be interested to see media continue to delve into this idea of transparency behind organisations that are funding this kind of work – the research and the deployment. There's a lot of private funding coming to them, and the question is, from whom? And what's the motivation behind it?"

Meanwhile, some projects have made commitments not to allow future buyouts by fossil-fuel companies; Peterson describes this as a sign that a project is acting in good faith.

[26] Low, S., Fritz, L., Baum, C.M. (2024). Public Perceptions on Solar Geoengineering From Focus Groups in 22 Countries. Communications Earth & Environment 5, 352. https://doi.org/10.1038/s43247-024-01518-0

Solar radiation modification's bad image

These technologies tend to be negatively portrayed in media. The postapocalyptic film *Snowpiercer* depicts a future where overuse of stratospheric aerosol injection plunges the planet into another ice age. And in the novel *Ministry for the Future*, one nation decides to begin stratospheric aerosol injection without seeking agreement from neighbouring nations or the global community at large. Though fictional, both the film and the novel depict real fears about the way these technologies might be used.

In addition, solar radiation modification is often connected with conspiracy theories, such as the notion that the government can control the weather, or that the chemical trails left by aircraft contain mind-altering or toxic particles.[27] A number of bills to ban solar geoengineering research in American state legislatures appear to be driven by conspiracist thinking.[28]

[27] Debnath, R., Reiner, D.M., Sovacool, B.K., Müller-Hansen, F., Repke, T., Michael Alvarez, R.M.,Fitzgerald, S.D. (2023). Conspiracy Spillovers and Geoengineering. iScience 26, 3. https://doi.org/10.1016/j.isci.2023.106166

[28] Politico. (2025). Conspiracy Theories Fuel State Efforts to Ban Geoengineering. Retrieved from https://www.eenews.net/articles/conspiracy-theories-fuel-state-efforts-to-ban-geoengineering

Part two: The cost of bad coverage

Running Tide was a carbon-dioxide-removal start-up that aimed to grow seaweed very quickly, soaking up CO_2 in the process, then sink it to the seafloor, storing carbon in the deep. It received a great deal of glowing media coverage over its seven years of existence, as well as investments from the likes of Shopify and the Chan Zuckerberg Initiative.

A *Fast Company* story described Running Tide's carbon-removal plans as though they were already taking place, exactly as projected.[29] In fact, another journalist noted two years later, the kelp-growing thing didn't really work, and the company had switched to another idea: sinking wood chips. James Temple's story at *MIT Technology Review* is the only one I was able to find that brought scepticism to Running Tide's assertions before the company closed down in disgrace.[30]

The plaudits for Running Tide continued until 14 June 2024, when an Icelandic media outlet, *Heimildin*, published an investigation looking into the company's activities. It had pivoted to the idea of sinking buoys made of wood chips coated in kelp spores off the coast of Iceland. The wood chips would otherwise be burned, releasing their carbon into the atmosphere, so Running Tide counted this as a removal.

The Icelandic government had granted Running Tide a first-of-its-kind research permit allowing them to sink the wood chips. The *Heimildin* investigation found that the buoys never existed, that Running Tide was in fact dumping wood chips coated in limestone into the ocean, and that the company's claims about carbon sequestration could not be substantiated.

Would sinking wood chips sequester carbon? Yes, said Running Tide. It's impossible to tell, said the scientists interviewed by *Heimildin*. That hadn't stopped Running Tide from selling carbon offsets to Microsoft and Shopify.

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[29] Fast Company. (2020). Forget Planting Trees: This Company Is Making Carbon Offsets By Putting Seaweed on the Ocean Floor. Retrieved from https://www.fastcompany.com/90548820/forget-planting-trees-this-company-is-making-carbon-offsets-by-putting-seaweed-on-the-ocean-floor

[30] MIT Technology Review. (2022). Running Tide Is Facing Scientist Departures and Growing Concerns Over Seaweed Sinking for Carbon Removal. Retrieved from https://www.fastcompany.com/90548820/forget-planting-trees-this-company-is-making-carbon-offsets-by-putting-seaweed-on-the-ocean-floor

The same day the investigation was published, Running Tide announced it was shutting down.[31] The company had laid off its Icelandic staff the previous month.

Why wasn't there more scepticism about Running Tide before the wood chips hit the fan? Climate scientist David Ho told me that this level of credulity is common in the field. "I think sometimes a company will say, 'We've got this idea', and then it will be reported as this magical solution, and it's just completely not critical," he said. "And then that leads to maybe the company getting funding."

Part of the issue, Ho pointed out, is that there are few experts, and many people with relevant experience are involved in the carbon-removal industry itself. He is the perfect example – he's also the chief science officer of a start-up seeking to create ways of measuring carbon stored in the ocean. His company, [C]Worthy, is funded by some of the same groups that funded Running Tide.

The lack of scrutiny across the industry may inflate funding rounds, but could ultimately have terrible effects, said Ho, if a company turns out to have been misleading investors or stretching the truth. "I think it's really damaging for such a young field, because then there's the tendency for people to say, 'Well, maybe all companies are doing this.' It hurts everybody."

[31] LinkedIn. (2024). Running Tide Was Built For Our Kids. Retrieved from https://www.linkedin.com/pulse/running-tide-built-our-kids-runningtide-lapne

Lesson one: “Please stop mixing up carbon removal and carbon capture”

The number one complaint about the media that I heard while reporting this paper – from scientists, non-profits and entrepreneurs alike – was that journalists frequently confuse carbon removal with carbon capture.[32]

Who can blame us? These sound like synonyms for the same thing.[33] In reality, they are different processes with different outcomes. Moreover, one field is mired in controversy, and the other is not.

The difference between carbon removal and carbon capture

Carbon *removal* results in less carbon dioxide in the atmosphere than before. Think of it as cleaning up pollution.

Carbon *capture* doesn’t change the amount of carbon dioxide in the atmosphere. Rather, it stops carbon dioxide from being emitted in the first place. Think of it as catching pollution at the source.[34]

Carbon capture technology is most often used by fossil-fuel-powered industrial processes like power plants and factories. Because their emissions are being captured (in theory), these facilities then claim climate neutrality.

But carbon capture has a credibility problem. A 2024 Vox and Drilled investigation found that no CCS facility has yet been able to capture as much carbon dioxide as planned. Meanwhile, fossil-fuel companies have been deliberately misleading governments and the public about the effectiveness of carbon capture:

> *Stanford University researcher Mark Jacobson said that because it also requires energy and materials to function, CCS attached to a fossil-fuelled power plant is still worse for the climate than replacing fossil energy with renewables. “They actually increase carbon dioxide emissions by doing this, in addition to increasing air pollution,” he said,*

[32] Actually, what they said was, “Stop confusing CDR with CCS,” because everybody talks in acronyms.
[33] Oxford University climate scientist Myles Allen suggests the term “carbon disposal” instead of carbon removal in order to draw a parallel with the waste industry.
[34] Carbon180. (2024). The Difference Between Carbon Removal and Carbon Capture. Retrieved from https://carbon180.org/blog/the-difference-between-carbon-removal-and-carbon-capture

> *referencing a study he conducted in 2019 quantifying the life-cycle CO_2 emissions of various carbon capture scenarios.*[35]

Carbon removal is often met with the same suspicion as carbon capture, simply because most people don't understand they are different industries. Aissa Dearing, an Oxford PhD student and environmental justice advocate, recommends avoiding the terminology of the field.

"It really wasn't until I got into the carbon-removal space that I learned the difference between carbon removal, DACS, CCUS, CCS – and that all just gets conflated," they said. "So everyone hates carbon removal, and oftentimes using the language of carbon removal will put people off."

Dearing has been trying to find a new vocabulary for communicating aspects of this industry to the public: "I often speak in the language of climate repair."

Yet another confusing piece of terminology

Unhelpfully, there is a form of carbon *removal* called "direct air capture". Because of its name, it is often described as carbon *capture* by the media – such as in this August 2024 BBC News story, 'Is carbon capture an efficient way to tackle CO_2?'[36]

The story is not about carbon capture at all – it's about carbon removal – which makes the question in the story's headline impossible to answer.

As if that weren't bad enough, the technology known as BECCS – bioenergy with carbon capture and storage – is a form of carbon *removal*. As media researcher William Lamb puts it: "Capturing carbon from a coal power plant is different from capturing carbon from a bioenergy power plant and then storing it." Only the second removes carbon.

If unclear, the main question to ask is: does this technology reduce the sum total of carbon dioxide in the atmosphere?

One tree is not the same as another

There are other mistakes at play. Media researcher William Lamb, from the Potsdam Institute for Climate Impact Research, is the author of an upcoming paper which defines and assesses responsible communication of carbon removal. He told me

[35] Vox. (2024). Oil Companies Sold the Public on a Fake Climate Solution—and Swindled Taxpayers Out of Billions. Retrieved from https://www.vox.com/climate/363076/climate-change-solution-shell-exxon-mobil-carbon-capture

[36] BBC. (2024). Is Carbon Capture an Effective Way to Tackle CO2? Retrieved from https://www.bbc.co.uk/news/articles/clmydee2grno

about coming across newspaper stories that mixed up carbon-dioxide-removal with offsets. Both involve forests, but the outcomes are very different.

In the first instance, a new forest is planted to soak up carbon dioxide. In the case of carbon offsetting, an existing forest is prevented from being cut down. No additional trees are added, so no extra carbon is being removed.

"That's a really important distinction to make," said Lamb, "especially because the offset market has been revealed to not function terribly well. Actual carbon-removal projects in the forestry space have a much higher price point than offset projects."

In addition, the offsetting industry, like carbon capture and storage, has been found to contain bad actors. In January 2023, the *Guardian* published a major investigation revealing that most carbon offsets from a large supplier were fraudulently created.[37] It led to a broad withdrawal from the carbon offset industry – including from legitimate companies, as investors sought to avoid the reputational risk of association with the industry.

Because the technologies are complex, similar, and reputationally fraught, the risk of confusion is high. When Lamb was reading media coverage for his study, he often found it hard to figure out which technologies authors were talking about: "You're left wondering, is this more of a carbon-negative process or a carbon-neutral process?"

As a science journalist, I have a personal motto: "No one ever said that something was too easy to understand." In this corner of the climate-repair field, it seems safer to over-explain than risk the opposite.

[37] The Guardian. (2023). Revealed: More Than 90% of Rainforest Carbon Offsets By Biggest Certifier Are Worthless, Analysis Shows. Retrieved from https://www.theguardian.com/environment/2023/jan/18/revealed-forest-carbon-offsets-biggest-provider-worthless-verra-aoe

Lesson two: Consider word choices in describing technology

Journalists can dramatically influence how people perceive technologies by the manner in which we describe them. This is called 'framing' by social scientists. If we want to present technologies in a neutral way to the public, there are some important considerations to be made about the words we use.

The most significant choice is whether we liken these technologies to natural processes or emphasise their industrial nature. Take stratospheric aerosol injection – it could be described as spraying sulphuric acid into the upper atmosphere, or as mimicking the effects of a volcanic eruption. A direct-air capture facility could be described as like a factory, or like trees. Each contains truth.

"There's tons of stuff that we know affects public attitudes to any kind of technology," said Rob Bellamy, a social scientist at the University of Manchester. "Naturalness is a huge one."

Research shows that people are predisposed to like technologies that seem natural, and to distrust those that seem unnatural, or that involve 'tinkering with nature'.

"Now, the interesting thing is that naturalness itself is a social construct," said Bellamy. "Everything's natural. Humans are natural, and the things that we make come from nature. So where we draw the lines on what is natural and what is unnatural is something done by people."

Some climate-repair projects are framed as 'nature-based solutions' or 'natural climate solutions', because they involve the ocean, forests, wetlands, or agricultural areas. This framing distorts people's ability to properly consider the merits and downsides of these projects, said Bellamy, because people are biased towards associating 'natural' with 'good'.

When Bellamy asks people their opinions on carbon-removal techniques, he struggles to get people to consider the negative side of 'natural' projects such as tree-planting.

"Everybody loves trees, but tree planting can also be extremely problematic," he said. "It's really quite hard to get them to think about that.

“One thing I’m advocating for is for experts and communicators to really try and avoid framing things in terms of whether they’re natural or unnatural. It has arguably the biggest framing effect on how people perceive things.”

Using a broader range of framings, he wrote, would allow climate technologies to be evaluated in terms of their specific qualities.[38]

Finally, Bellamy advocates discussing climate-repair technologies individually rather than collectively. This is because they’re so different. Tree-planting and direct-air capture are both forms of carbon removal, for instance, but practically, they have little in common. “So instead of talking about ‘carbon removal’,” he said, “let’s talk about biochar, let’s talk about enhanced weathering, let’s talk about iron fertilisation, direct-air capture, and so on.”

Even the umbrella terms for the field are fraught, he said. “When people say ‘climate engineering’, it means different things to different people.” (The fact that in this paper I’ve grouped these technologies under ‘climate repair’ is, in itself, a questionable decision.)

When people use the term ‘geoengineering’, Bellamy said, it’s often to criticise or to dog-whistle at conspiracy theories. He no longer uses it, believing that the word serves to negatively frame the technologies it describes.

[38] Osaka, S., Bellamy, R., Castree, N. (2021). Communicating Carbon Removal. Wires Climate Change 12, 5. https://doi.org/10.1002/wcc.729

Lesson three: Avoid polarisation, pursue nuance, and add context

Media coverage of solar radiation modification tends to be one of two kinds, said Claudia Wieners: "Either being very critical – and there's a lot to criticise – or presenting it as a cool, scientific, novel method by overlooking issues.

"We should avoid falling into the trap of 'Wow, this is great because it helps,' or 'Wow, this is the way to hell because it has political dangers'."

Certainly, Wieners acknowledged, one story is more interesting than the other – people seem to prefer reading about solar geoengineering when it's described as "the way to hell" rather than as an issue with complex pros and cons.

"Very stark warnings, or cool scientists who press for a novel way to save us all, make for a more spectacular story than a balanced, 'Well, but it has risks, but not doing this has risks'. That's tiring, that's less spectacular, it's not so clickbaity. So it's not done enough."

Carbon removal faces a similar issue. "There are both horrifying and mildly likeable scenarios for how carbon removal might be accomplished," wrote Holly Jean Buck in *After Geoengineering*. "The horrifying ones are easy to conjure to mind, while the likeable ones stretch the imagination."[39]

Because solar geoengineering sounds radical – and because it's long been scientifically uncool – it's tempting to use its outcast status as a hook into the story. Whitney Peterson said she's getting pretty tired of headlines that involve some version of 'Is this a bad idea whose time has come?'

"I think that the major pitfall that I see media unfortunately falling into," she said, "is the simplification of these things down to 'the new shiny object that's controversial'. It's so easy to just fall into the trap of pointing at all of the controversy of it, rather than the context."

[39] Buck, H. J. (2019). After Geoengineering. Verso Books.

For Peterson, the context is that we're not on track to meet our climate goals – rather, we're on track to face a difficult choice between severe climate change impacts and the use of technologies like solar geoengineering.

Multiple scientists have pointed out that it's disingenuous for media to describe the environmental impacts of carbon removal or solar radiation modification without placing them against the environmental impacts of climate change itself.

Think of the stakes in terms of whales, suggested David Ho. "If we don't do anything, a hundred whales die. If we do something, we kill two whales. That view needs to be presented."

In addition, it's important to emphasise that no climate-repair method provides a single solution to climate change. Yet some coverage of carbon removal fails to include this context, said William Lamb.

Lamb collected opinion pieces on carbon removal from media in the U.S., Canada, the UK, Australia, and New Zealand, ranking them on whether they clearly described the science and appropriately included context. "So we asked questions like, does an article mention the need to reduce emissions? Does an article give the impression that climate change can basically be solved with a single method?"

There was a national flavour to the stories he read. "In the Canadian context, some authors would lean on the fact that Canada has this amazing boreal forest that could basically offset all of Canada's emissions – which gives you a single solution to a problem. We were a bit wary of those kinds of discourses."

About a quarter of articles didn't mention the need to reduce emissions at all – a piece of context judged important by all media researchers.

Lesson four: Look beyond the technology to the social setting

Carbon-removal methods and solar-geoengineering techniques aren't just technologies – they also sit within social and political systems.

Research shows that the public is interested in who's going to be in charge of these technologies, who's going to profit from them, and how they're going to be managed. Will the public have a say? Will projects be run by communities, or outside actors? Who is compensated for any side effects? Where do the benefits go?

One study in the UK, for instance, found that people were more open to a particular type of carbon-removal project if it was going to be run by a local co-operative than by a company funded by private investment.[40]

Similarly, people are concerned that climate-repair technologies may turn out to be a mechanism for allowing big emitters to continue business as usual. Using these technologies isn't just a matter of obtaining permissions and determining an appropriate level of safety: it's also a matter of developing good governance structures around their use.

"Climate engineering has been stuck in the realm of 'technology', rather than understood as a variety of practices that include people in various relationships with nature and each other," wrote Holly Jean Buck in *After Geoengineering*.

> *Geoengineering talk often focuses on one moment – the decision to 'deploy', and how or whether publics will be a part of this decision. But looking at prospective decision points muddies this notion of a discrete decision. It's also not clear exactly who these 'decision makers' are. In much of our conversation about climate action, the citizen becomes a witness to history, to decision ceremonies of the powerful. Out of view are the backstories, the tiny actions that accumulated into a formal decision. It becomes*

[40] Cox, E., Bellamy, R., Waller, L. (2024). Public Attitudes and Emotions Toward Novel Carbon-Removal Methods in Alternative Sociotechnical Scenarios. Environmental Research Letters 19. https://doi.org/10.1088/1748-9326/ad5dd0

> *hard to imagine otherwise – that geoengineering could be carried out in conversation with civil society, much less led by us.*[41]

[41] Buck, H. J. (2019). *After Geoengineering*. Verso Books.

Conclusion

"We've arranged a society based on science and technology, in which nobody understands anything about science and technology," said the great science writer Carl Sagan in 1996, in one of his last interviews. "And this combustible mixture of ignorance and power, sooner or later, is going to blow up in our faces. Who is running the science and technology in a democracy if the people don't know anything about it?"[42]

The decisions that people make about when and where to allow climate-repair projects, and under what circumstances, are important and far-ranging. These conversations can be fostered or stymied by journalism.

In my own reporting on climate-repair projects, and particularly on what the public thinks about them, I found that social scientists who study the field are worried that these technologies may be cancelled before they get going.[43]

"I just feel like we're at a really vulnerable stage from a public perception standpoint," environmental social scientist Sara Nawaz told me. "I think that there's totally the risk that one or several projects that get really stigmatised can just delay things or even just totally kind of take it off the table."

Nawaz, who directs research at American University's Institute for Responsible Carbon Removal, was speaking about marine carbon-removal projects. But the risk extends across the field. Without a well-informed (and involved) public, conspiracist thinking arises.

Holly Jean Buck calls for "a Manhattan Project for conversation" to combat disinformation. She points out that the solution to disinformation isn't simply to pour more information on top of it, but rather to engage with people, to converse with them directly, to involve them in deliberation, to bring them into dialogue with each other, and to discuss topics with nuance and context.

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[42] I was alerted to this interview by a post by David Ho on Bluesky.

[43] Science. (2025). Failure to Communicate. Retrieved from https://www.science.org/content/article/geoengineering-fight-climate-change-if-public-can-convinced

Journalism could be a crucial part of this – but like these technologies themselves, we still have work to do.[44]

[44] Jacobin. (2024). A Climate Disinformation Focus Takes Us the Wrong Way. Retrieved from https://jacobin.com/2024/08/climate-disinformation-fossil-fuels-ngos

Reporting on Climate Repair: a tear sheet for journalists

🧠 William Lamb's checklist for responsible media coverage

Good reporting on carbon removal should:

🟩 Highlight the need to reduce emissions alongside removal.
🟩 Highlight where emissions come from.
🟩 Make clear that removal is not a substitute for reductions — and that cutting emissions comes first.
🟩 Avoid unconditional support or rejection.
🟩 Acknowledge that no single solution can fix climate change.
🟩 Identify and discuss risks.
🟩 Identify and discuss benefits.
🟩 Avoid confusing removal with offsets or avoided emissions.
🟩 Avoid confusing removal with carbon capture (which stores carbon not drawn from the atmosphere).
🟩 Avoid confusing removal with solar radiation modification.

💬 Bellamy & Raimi's four-point guide to effective communication

1. Be clear. Use accessible language and analogies, but clarify how carbon removal differs from related processes.
2. Be specific. Avoid "nature-based" or "natural" framing; refer to individual methods or precise scientific terms.
3. Be accurate. Emphasise that removals must complement, not replace, emissions reductions.
4. Be social. Explain the governance and social arrangements, not only the technology itself — showing the alternative paths implementation could take.

Questions to ask:

Can the project scale meaningfully?
Would it require, for example, sprinkling rock dust across a land area twice the size of Europe – or kelp growing around the entire coast of the Americas?

What are the costs or side effects?
Consider energy, water, land, transport, and waste-disposal demands.
Note: Early proof-of-concept projects have costs that may not reflect long-term realities, once economies of scale apply.

What are the benefits?
Will the project restore a landscape, cool a coral reef, or remove measurable carbon dioxide from the atmosphere?

How are results being measured — and by whom?
Is an independent measurement agency involved, or is the company self-reporting its results?

How are potential environmental impacts tracked?
Did the project take baseline measurements — showing what an environment was like before a new chemical or technology was added?

What do local communities think?
What kind of input do residents have?
Is the relationship between project and public two-way dialogue or one-way communication?

Who is funding the project?
What are the timelines, imperatives, and incentives? Is it funded by the sale of carbon-removal credits, and if so, how are those credits accounted for?

How is the project governed?
Who makes decisions about when the project starts or ends, and how it is run?

Compiled by Rebekah White, 2025. Based on original research and interviews for *The non-scientist's guide to reporting on climate repair*

Glossary of acronyms and terms

Avoided emissions When a choice is made to use a project or service that does not generate emissions, as opposed to one that does

BECCS Bioenergy with carbon capture and storage – a carbon-*removal* technique used by power plants that burn biomass (wood, farming waste, crops) for fuel

CCS Carbon capture and storage – not a carbon-removal technique, but a method of preventing emissions from occurring by sending them to storage

CCUS Carbon capture, usage and storage – also not a carbon-removal technique; same as above, except the emissions are used in an industrial process before being compressed, transported and stored

CDR Carbon-dioxide removal

CO_2 Carbon dioxide

DAC (or DACS) Direct air capture (and storage) – this is a carbon-*removal* method

GGR Greenhouse-gas removal – a term used to encompass carbon removal, methane removal and nitrous oxide removal

MCB Marine cloud brightening – a solar geoengineering technique where tiny salt particles are sprayed into clouds, making clouds bigger and reflecting more sunlight in order to cool areas of the planet

Mitigation deterrence The idea that carbon removal or solar radiation modification will disincentivise governments and companies from reducing their emissions

MRV Measurement, reporting and verification – the system used to determine if carbon dioxide has been removed, and how much

Negative emissions Another way of describing carbon-dioxide removal

NETs Negative-emissions technologies – in other words, projects to remove carbon or methane

OAE Ocean alkalinity enhancement – the idea that making seawater more alkaline will speed up its absorption of carbon dioxide from the atmosphere

OIF Ocean iron fertilisation – the idea that adding nutrients such as iron to seawater will increase phytoplankton growth, which will sequester carbon

Offsets When companies or individuals pay for a certain amount of carbon removal to compensate for emitting carbon dioxide

Residual emissions These are carbon-dioxide emissions judged to be impossible to eliminate because they're part of a crucial industry

SAI Stratospheric aerosol injection – the theory that spraying tiny particles into the stratosphere will cool the planet, as volcanic eruptions sometimes do

Solar geoengineering An umbrella term to describe theories for deflecting sunlight from the earth, resulting in cooling

SRM Solar radiation modification – see the definition of 'solar geoengineering' above

Termination shock The idea that suddenly stopping solar radiation modification will result in a dramatic increase in warming

VCM Voluntary carbon market – companies and individuals choosing to reduce or offset their emissions without being forced to by regulations